

## CADASTRE OF CAVES IN ROMANIA - LEGAL ASPECTS

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**ABSTRACT:** *The development of caves takes place naturally underground, but the lands above the caves are also involved. That is why there is a need to represent them on cadastral plans: both underground and on the surface through the horizontal projection of the naturally created gaps (above the cave) to establish the protected area;*

**Keywords:** *cave; protected areas; horizontal projection of naturally created gaps;*

### 1. Introduction

A cave is a natural cavity formed in the earth's crust (it can be made up of several galleries, halls, wells and chimneys and can have more than one entrance), wide and deep enough to allow the entry of man while presenting a unique ecosystem whose resources are represented by values of nature: economic (water, limestone, guano, tourism, therapy), scientific (geological and mineral structures, underground landforms, paleontological, archaeological and historical sites, sediments, cave fauna and wild species) cultural-educational (spiritual, religious, aesthetic, recreational and educational).

These are part of the geological and speleological heritage assets, as natural assets of the underground, they are public property of the state and are also included in the area of protected natural areas as speleological (underground) formations of special value, with a special regime of protection and conservation. The responsibility for managing this area in Romania rests with the National Agency for Protected Natural Areas (N.A.P.N.A.) and the categories of protected

natural areas in Romania are classified into four areas as follows (Fig. 1).

### 2. Data processing

The establishment of the natural protected area regime is carried out by law, by decision of the Government, by order of the head of the central public authority for environmental protection, by decisions of the county or local councils, depending on the areas of interest.

The proposal for the establishment of the protected natural area regime is made on the basis of a Documentation for the Establishment of the Protected Natural Area Regime.

This documentation must include:

- the scientific substantiation study;
- cadastral documentation** with the limits of the protected natural area, highlighting the categories of land use;
- the opinion of the Romanian Academy.

The proposals for the designation of new protected natural areas of national interest are carried out taking into account the normative content of the documentation necessary for the

Natural protected areas of national interest:	Protected natural areas of international interest:	Protected natural areas of community interest - "Natura 2000" sites:	Natural protected areas of county or local interest
<ul style="list-style-type: none"> <li>• Scientific reservations</li> <li>• National Parks</li> <li>• Monuments of nature</li> <li>• Natural reserves</li> <li>• Natural parks</li> </ul>	<ul style="list-style-type: none"> <li>• Natural sites of natural and cultural world heritage – The Paris Convention</li> <li>• Geopark</li> <li>• Wetlands of International Importance – The Ramsar Convention</li> <li>• Biosphere Reserves – MAB/UNESCO Committee</li> </ul>	<ul style="list-style-type: none"> <li>• Sites of Community Importance – SCI</li> <li>• Special conservation areas</li> <li>• Areas of special avifaunistic protection - SPA</li> </ul>	<ul style="list-style-type: none"> <li>• Established only on the public/private domain of administrative-territorial units</li> </ul>

Fig. 1. Categories of Protected Natural Areas of Romania

establishment of the regime of natural protected areas of national interest contained in Order no. 1.710 from November 1, 2007 (Fig. 2).

coordinates of the center of the area and of the limits, in the direction of the cardinal points or inflection points;

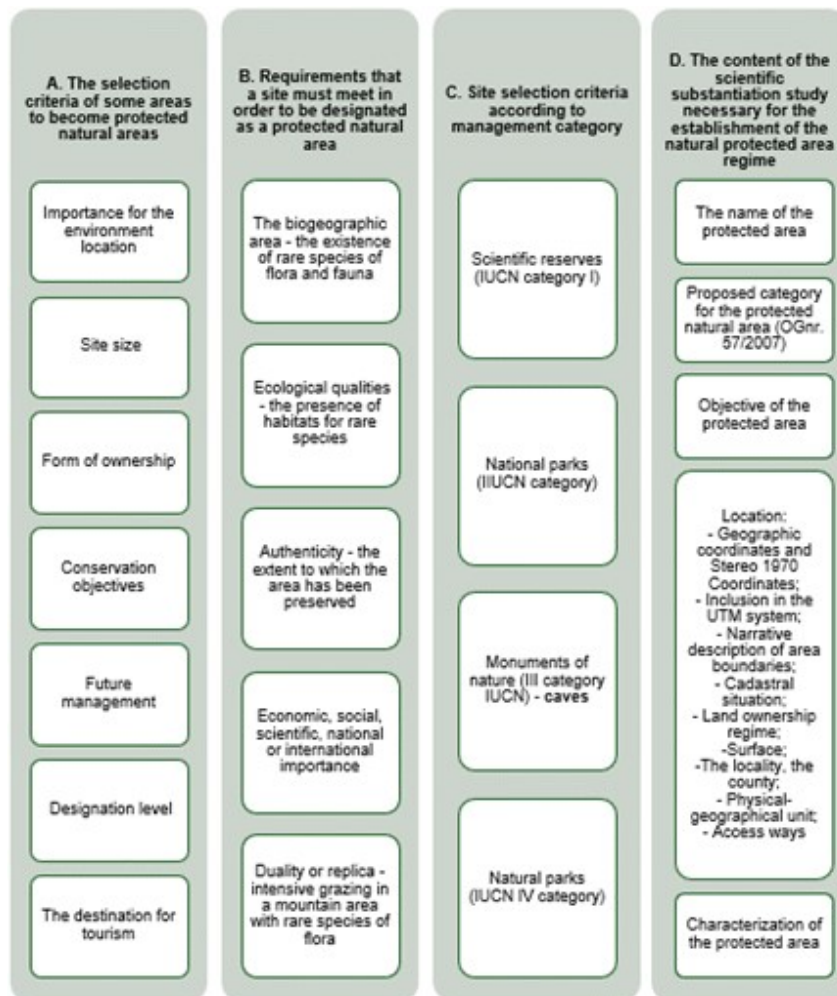


Fig 2. The selection criteria for some areas to become protected natural areas

### 3. Material and methods

The scientific substantiation study in order to establish the natural protected area regime must be structured taking into account the following aspects:

1. *Name of the protected area;*
2. *The category proposed for the protected natural area (according to OUGnr. 57/2007);*
3. *The objective of the protected area (with the purpose for which the conservation of the area is proposed).*
4. *Location:*
  - a. geographic coordinates and Stereo 1970

- b. inclusion in the UTM system (grid 10 x 10 km, 50 x 50 km);
- c. narrative description of the boundaries of the areas (identifiable landmarks in the land, either natural or man-made, will be taken into account; in the case of water basins, an imaginary line will be drawn parallel to the shore, approximately 20 m from it, at the maximum elevation of water);
- d. the cadastral situation. Land ownership regime (privately owned areas will be avoided as much as possible);
- e. surface;
- f. locality, county;
- g. physical-geographical unit;

- h. access ways.
5. *Characterization of the protected area*
- description of the general aspect of the area;
  - geological structure (it will be detailed in the case of geological reservations);
  - soil (pedology);
  - waters (hydrology);
  - waters (hydrology);
  - flora and vegetation (plant species for which the establishment of the protected area is proposed, etc.);
  - fauna (species of animals for the protection of which the establishment of the protected area is proposed, etc.)
6. *Internal zoning* (optional). Proposal of a zone of strict protection and/or full protection within the protected area, reasoned. Separate documentation is required for scientific reservations.
7. *State of the area*, anthropic pressure, existing and planned facilities and/or constructions (the existence of objectives that could have negative influences on the area).
8. *Minimum measures* proposed to conserve the area.

In the content of the documentation necessary for the establishment of the regime of natural area protected of national interest, the following must be attached:

- a) General map (of the country, of the county) with the marking of the location of the area.
- b) Topographic/geomorphological map, at a convenient scale, depending on the extent of the area (for example, 1:5,000, 1:25,000). Boundaries will be made in the Stereographic 1970 projection system. Marking of internal zoning, if such zoning is proposed. The limits of the protected natural area will be attached, in digital format, as vectors with geographic reference in electronic format.
- c) Map of the forestry facilities (for areas located fully or partially in the forest fund), plus the list of production/development units included in the proposed area.
- d) Land use categories, highlighting their ownership type.
- e) Geobotanical map-optional.
- f) Map with the location of the target species (plants, animals) - optional.
- g) Other specific maps (for example, geological, pedological, hydrographic, etc.) - optional.
- h) Overall and detail photos - optional.
- i) Identification data of the proposer and who

drew up the documentation;

- j) The point of view and/or opinion of the local public authorities. The point of view of the forestry, agricultural department, of the commercial companies involved or of the owners and administrators of the lands;
- k) Opinion of the Romanian Academy - Commission for the Protection of Natural Monuments.

It is observed that the activity of the geodetic engineer is absolutely necessary in the correct establishment of these protected natural areas, both in location, shape and surface, as well as in establishing the category of use and the owners who prove the right of ownership in these areas.

But in these areas marked on the surface of the earth there are also caves, which develop naturally underground in the form of horizontal or slightly inclined galleries or in the form of vertical or strongly inclined galleries (avenues), halls, wells, chimneys, siphons, etc., which connect to the surface through the mouth of the cave.

These galleries can be superimposed with different directions, they may or may not be connected to each other, but regardless of their location, they must be represented on topographic plans.

Speleometry (composed of two ancient Greek words σπήλαιον ("cave") and μέτρον ("measurement")) is a technique for measuring the dimensional features of underground caves that appeared in the 20th century with the development of speleological activities that determine the length or depth such as the volume of an underground room, the depth of a vertical shaft, or the maximum extent between two points in a cavity. An important element in establishing the link between the cave and the land surface is the relief above the cave.

The cadastre of caves (in GIS systems) links the location of the cave to the cave entry point. If a cave has several entrances, the cave cadastre must represent the coordinates of each entrance on the cadastral plan.

The owners of the land on the surface of the cave can still use the surface of the shelters or the vestibular area of certain caves in the Apuseni Mountains, for example, and the shelters and the first cave rooms located near the houses are set up as stables or warehouses. In other places houses, monasteries were built.

For this reason, the importance of the representation on the plan of the footprint of the

cave on the surface and the precision of its representation is particularly important in order to rigorously establish the area of the footprint within the natural protected area in order not to affect the owners of the land on the surface and for the safety of granting building permits in these areas (Fig. 3, 4).

For example, based on SLAM technology, Trion S1 - portable 3D scanner - can quickly perform high-quality scans in real time underground and obtain high-quality 3D maps. The light weight of the LiDAR scanner allows easy transportation in caves because it can be held in the hand. The LiDAR SLAM scanner allows

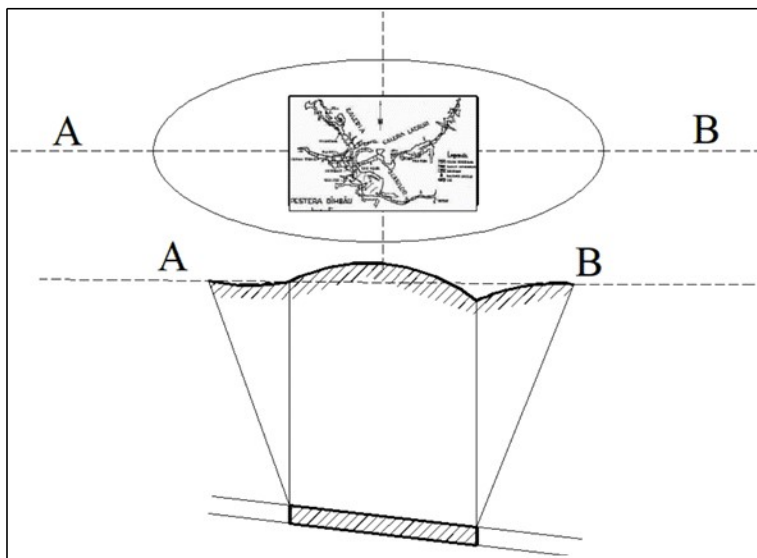


Fig. 3. Horizontal projection of the naturally created voids to establish the footprint of the cave on the earth's surface



Fig.4. Framing the horizontal projection of the Dâmbău Cave openings in the surface of the natural area ROSCI0253 Trascău



Fig. 5. The gallery decorated with bright yellow draperies with lace borders and the Lake that formed in the cave - personal photos.

manual scanning of enclosed spaces where GPS does not work (relying on lasers rather than GPS). In places where the GPS signal is blocked by obstacles or where large equipment cannot enter, the portable scanner can collect the most accurate data quickly.

These maps made underground in connection with points on the surface offer us the possibility of representing the footprint of all the underground voids on the surface in order to represent the limits. Having these precisely defined limits, the owners of the land on the surface can know the restrictions and the authorization of works of any kind on the surface without endangering the caves.

## References

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## 4. Conclusions

We want to carry out these measurements with modern technology in the Dâmbău Cave, located in the Trascău Mountains, Alba county, and to represent in a future work both the 3D map of the cave and the projection (footprint) of the cave on a horizontal plane in relation to the surface, because until now there are only classical measurements performed.

The beauty of the cave deserves to be shared and its protection and the species of bats present should place the cave in the class of national importance.